DUB
DESIGN
USE
BUILD

W PAUL G. ALLEN SCHOOL
OF COMPUTER SCIENCE & ENGINEERING

CSE 440: Introduction to HCI

User Interface Design, Prototyping, and Evaluation!

Lecture 05: Design Principles II

Instructor: Amy Zhang, 1/19/2021

Today's Topics

- UI Hall of Fame or Shame

- Design Principles: Safety and Efficiency

  - Safety

    - Kinds of Errors

    - Preventing Errors

  - Efficiency

    - Model Human Processor

    - Fitt's Law

- Present some of your team's 2a sketches to another team!

UI Hall of Fame and Shame

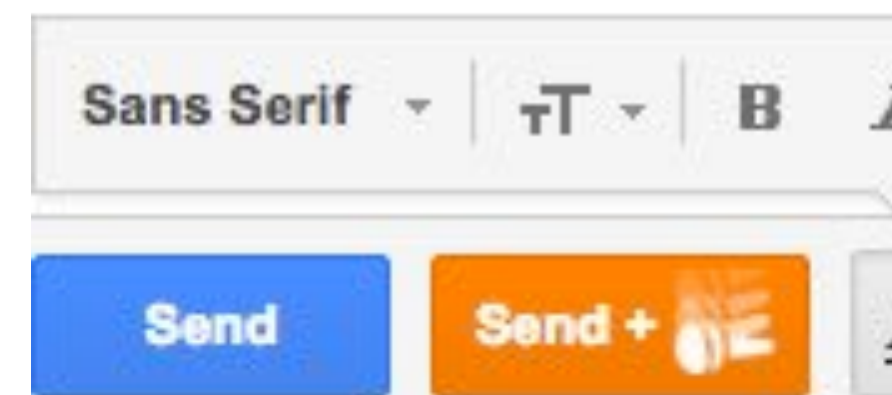# Google's Mic Drop April Fools 2016

"Today, Gmail is making it easier to have the last word on any email with Mic Drop.

"Simply reply to any email using the new 'Send + Mic Drop' button.

"Everyone will get your message, but that's the last you'll ever hear about it. Yes, even if folks try to respond, you won't see it."

What kind of error would be
    common with Mic Drop?

How might these errors have been prevented?

polyorchid said:

I sent two professional emails and accidentally hit the orange button. It just says SEND on it. It doesn't say anything on it about an animation or anything. Thanks Google for possibly losing me a job. Thanks a lot. I'm so angry.

+3

Funeral arrangements for Katie

Jonathan Anderson <j.anderson@walkerfuneralh   9:01 PM (2 minutes ago)
to Melanie

Melanie,

We're so very sorry to hear of the tragic loss of your daughter.

Your brother-in-law Louis suggested we reach out to you to begin funeral arrangements. Please let us know how we can be of assistance to you in this difficult time.
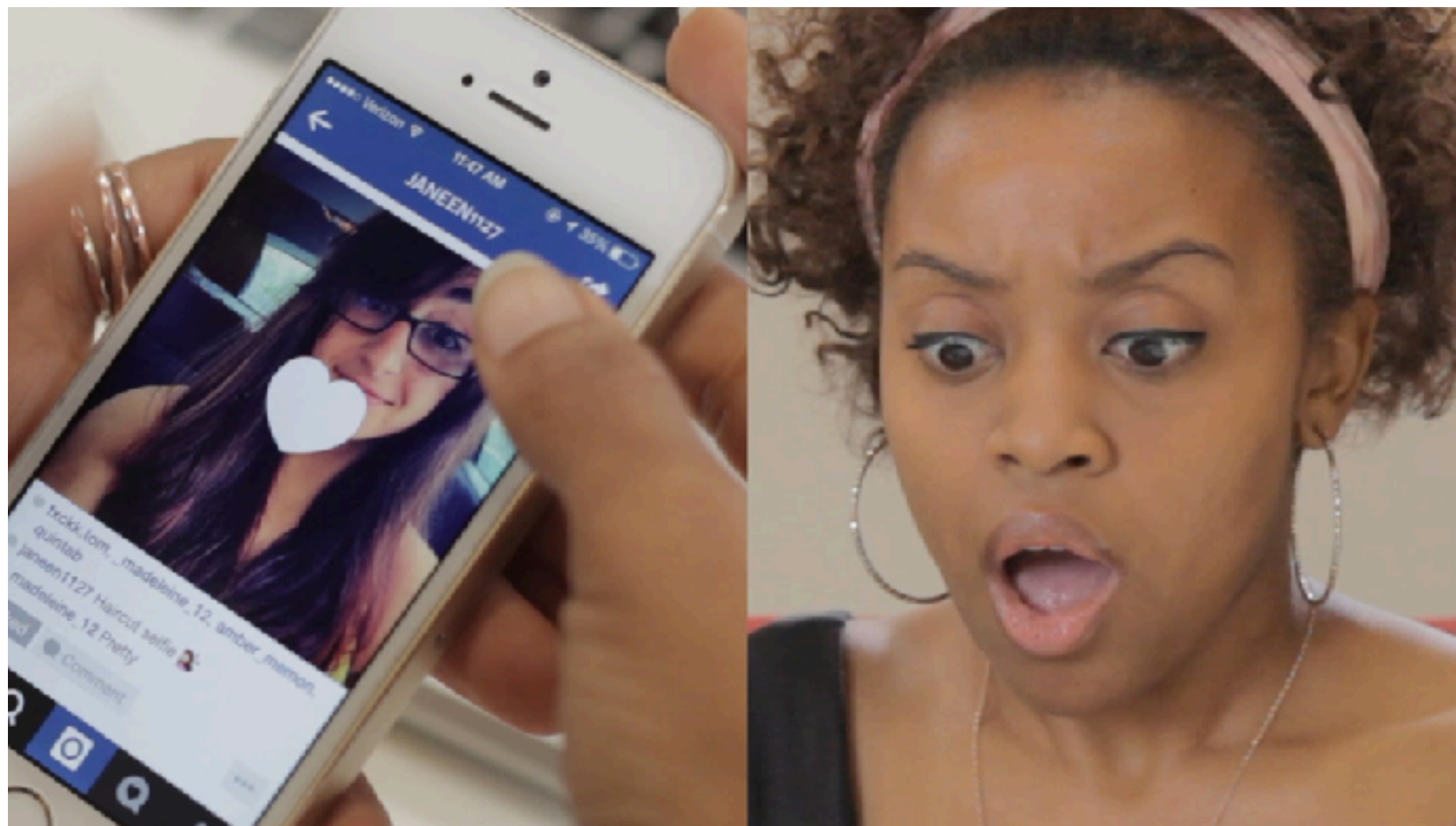
Justin Boxill said:

You can't. There is another post that this thing is an April fools prank. I just sent off an email with my resume to the first person who wanted to interview me in months. I clicked the wrong button and sent it with the mic drop. Well, I guess I'm not getting that job. Words cannot describe how pissed off I am right now. I'm actually shaking. One click, ONE CLICK and I lost the job. Goddamnit. Not funny, google. I'm going to go cry now.
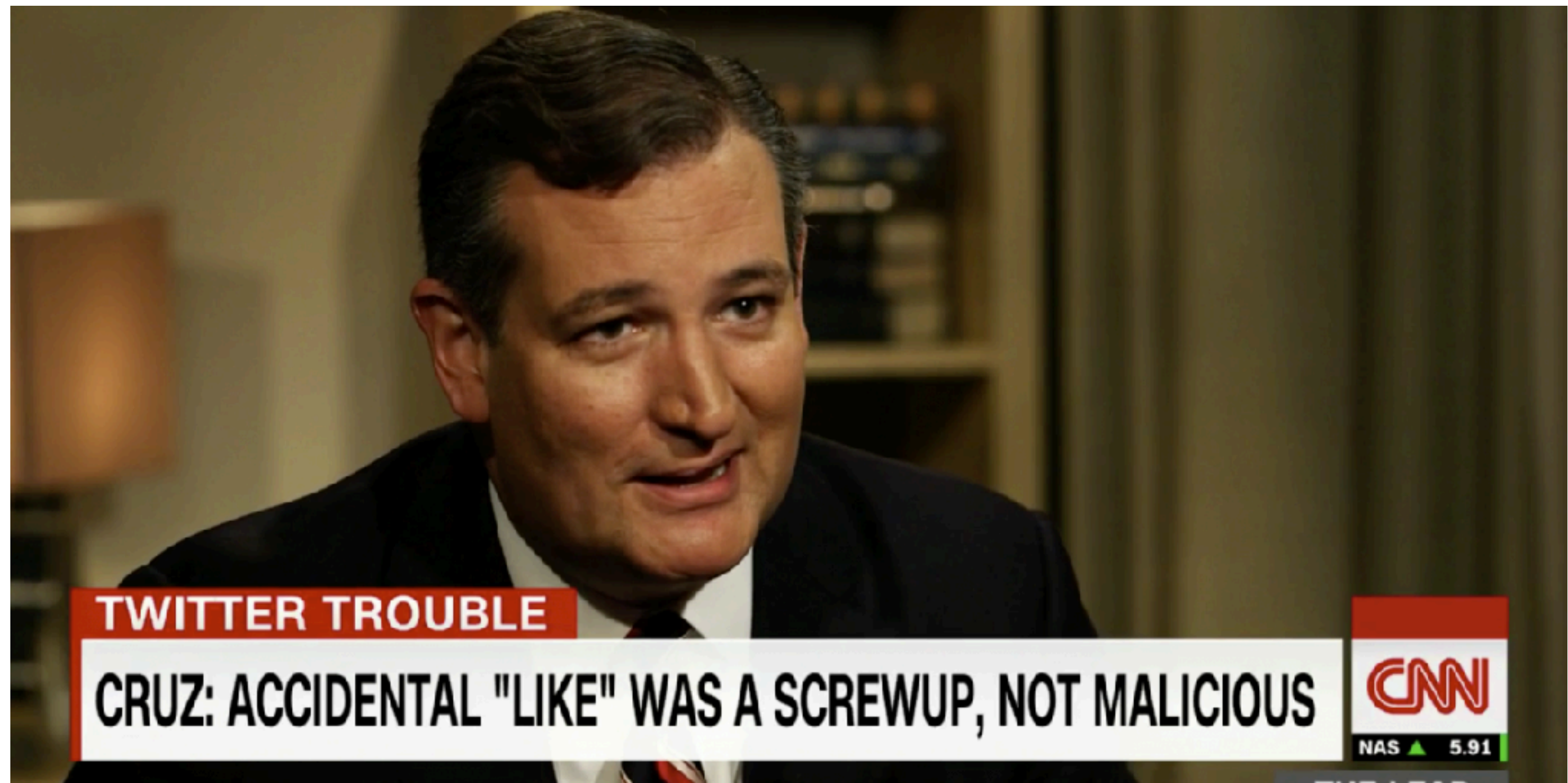
+1

Hall of Fame or Shame?

The "Accidental Like"

TWITTER TROUBLE

CRUZ: ACCIDENTAL "LIKE" WAS A SCREWUP, NOT MALICIOUS

CNN
NAS ▲ 5.91

Tweets	Following	Followers	Likes
19.4K	7,740	3.01M	1,248

Follow

Ted Cruz ✓
@tedcruz

Father of two, @heidiscruz's husband, fighter for liberty. Representing the great state of Texas in the U.S. Senate.
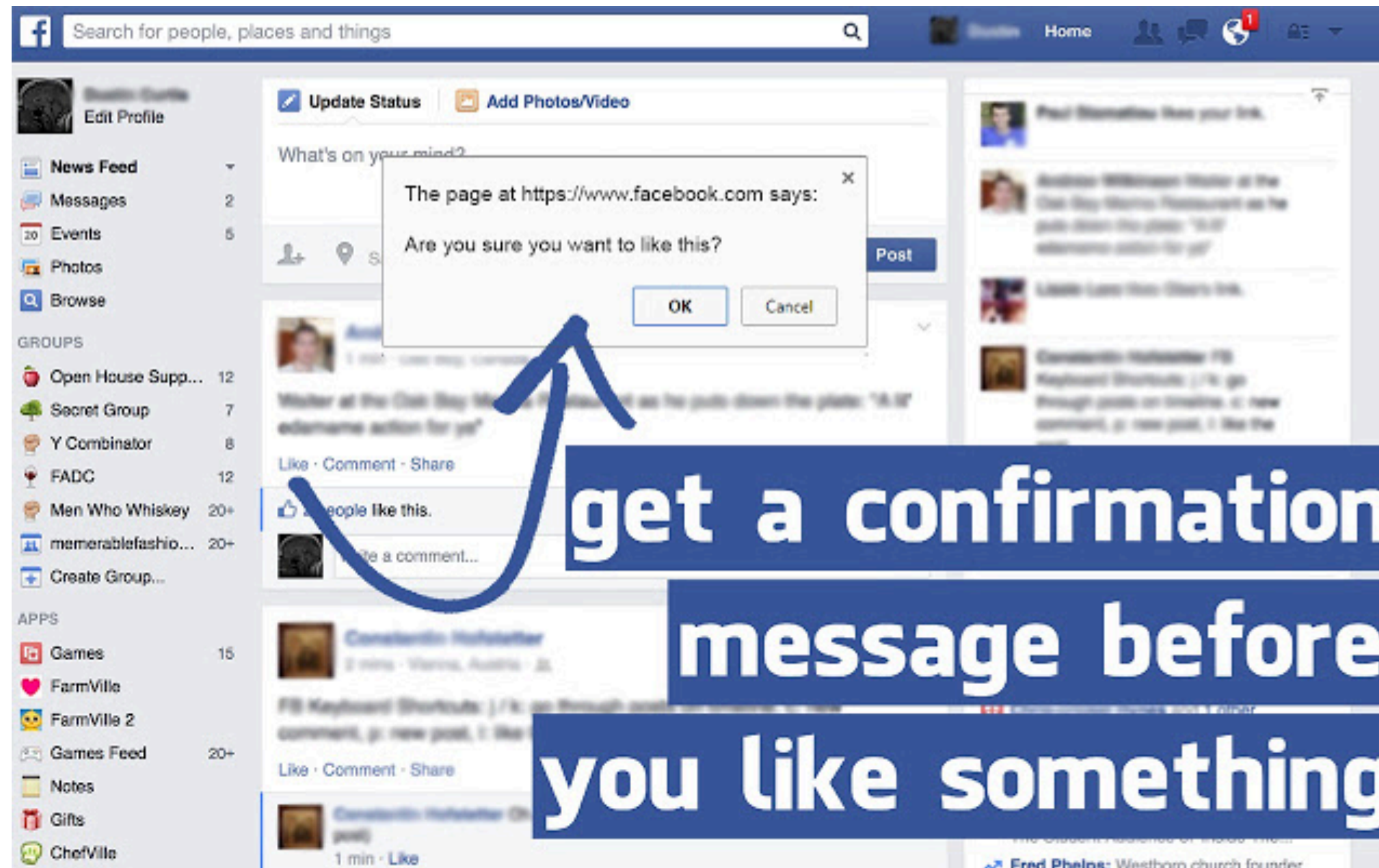
📍 Houston, Texas

🔗 tedcruz.org
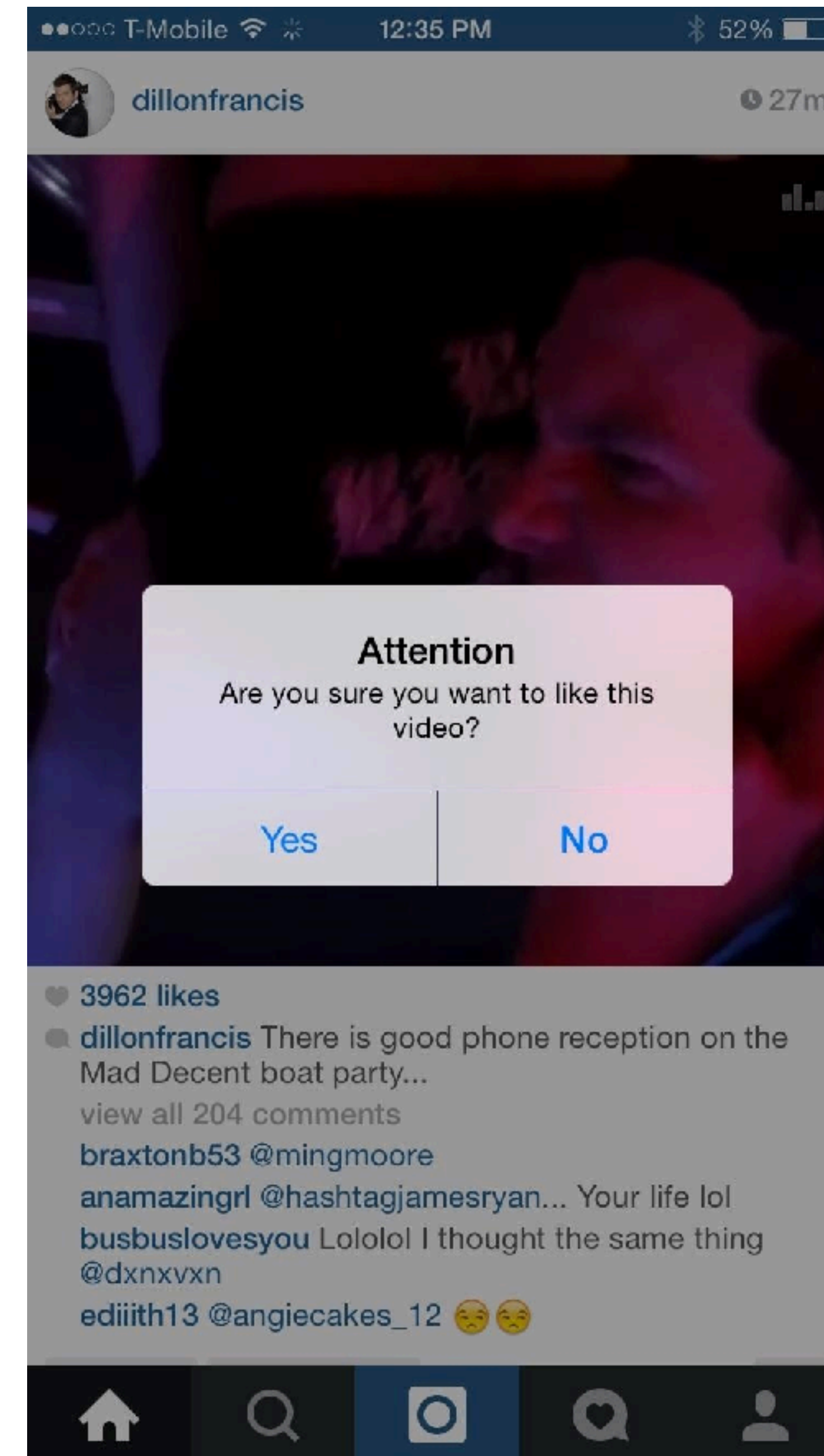
📅 Joined March 2009

🎂 Born on December 22

Likes

Sexuall Posts 😈 @SexuallPosts · Sep 11

get a confirmation message before you like something

How might you prevent this error?
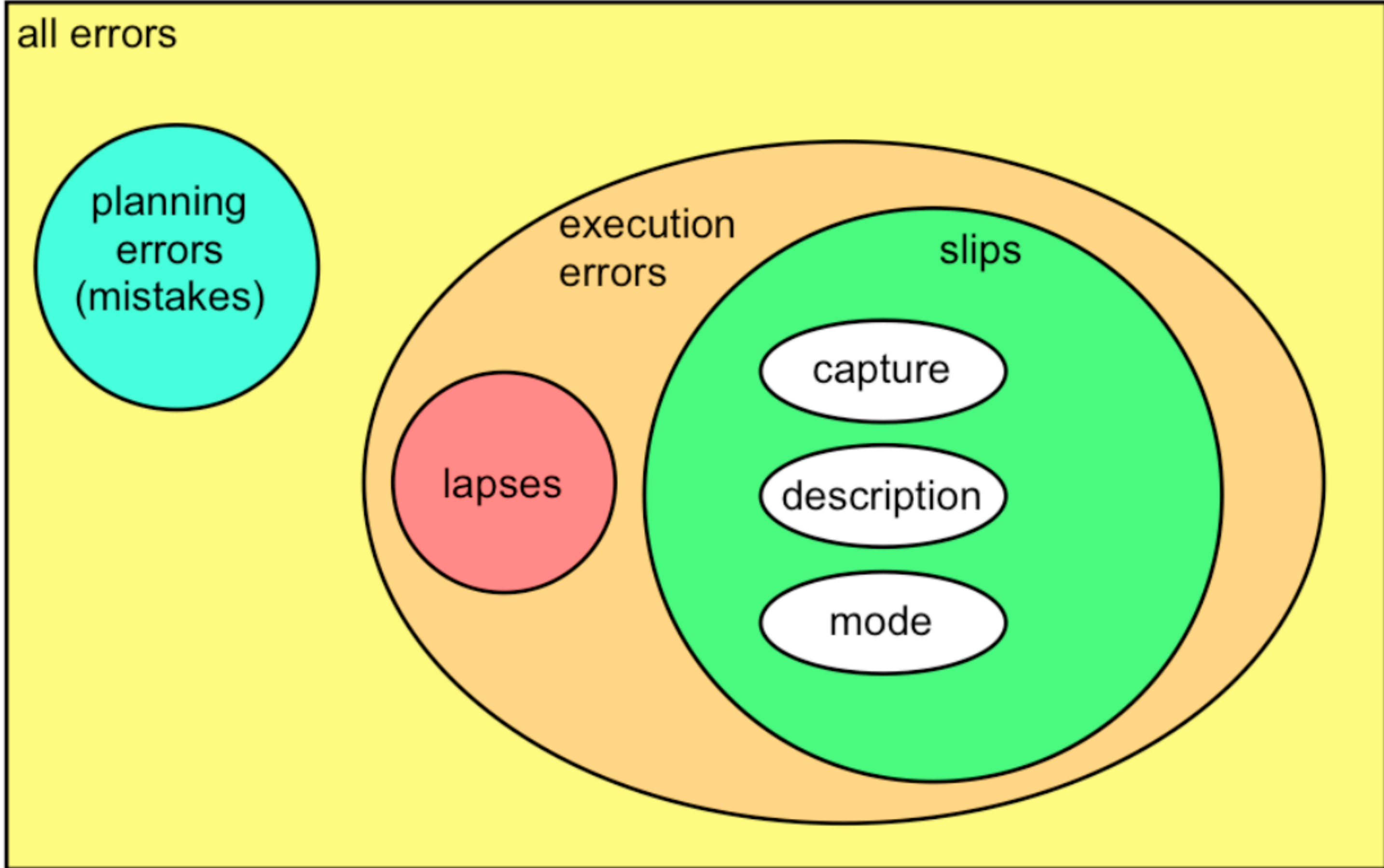
Safety

Kinds of Errors

Kinds of Errors

- **Slips and Lapses**
  - Failure in successfully executing a skill that a user has already learned
  - **Slip**: failure due to execution or control
    - example: missing the button on a click, Ctrl-V instead of Ctrl-C
  - **Lapse**: failure due to memory
    - example: forgetting to add attachment to email
- **Mistakes**
  - Error made in planning or rule execution
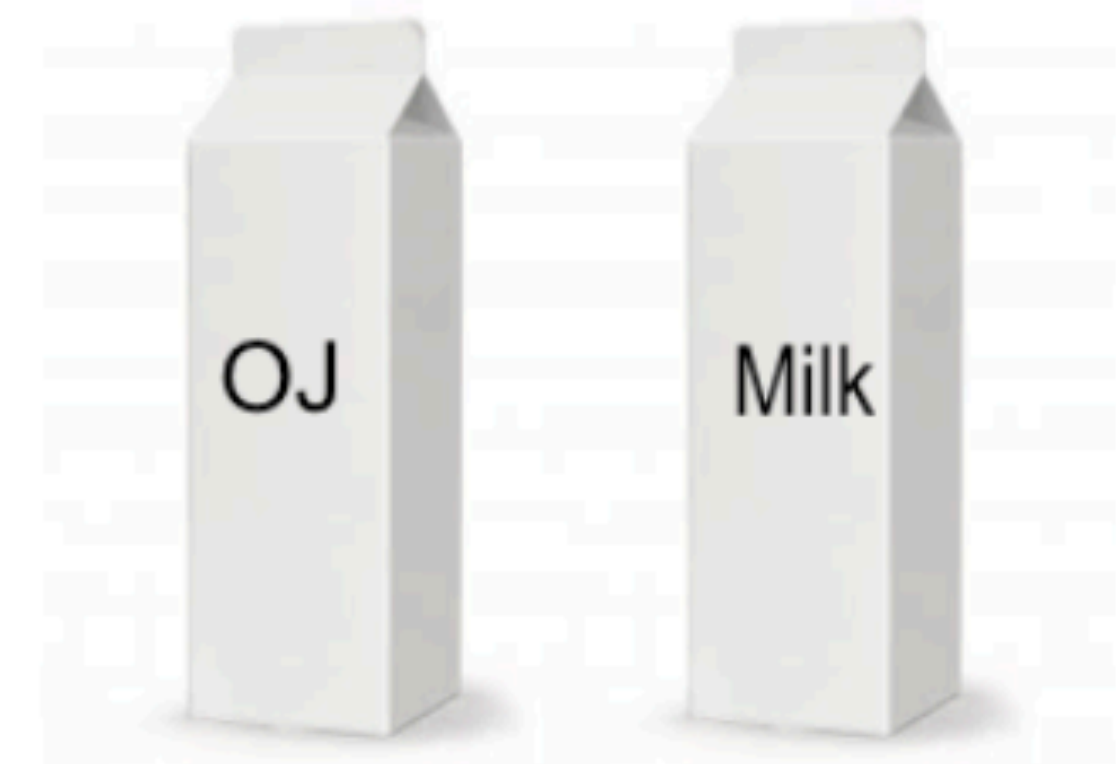
Kinds of Slips

- **Capture Slip**

  - a person starts executing one sequence of actions, but then veers off into another (usually more familiar) sequence that happened to start the same way

  - Ex: Leave your house and find yourself walking to school instead of where you meant to go

  - EX: In the text editor vi, it's common to quit the program by issuing the command ":wq", which saves the file (w) and quits (q). If a user intends just to save the file (:w) but accidentally quits as well (:wq), then they've committed a capture error.

Kinds of Slips

- **Description Slip**
  - Two actions are very similar. The user intends to do one action, but accidentally substitutes the other.
  - Ex: reaching into the refrigerator for a carton of milk, but instead picking up a carton of orange juice and pouring it into your cereal.

Kinds of Slips

- **Mode Error**

  - Modes are states in which the same action has different meanings. Slips happen when you forget which mode you are in.

  - Ex: if the user means to type lowercase letters but doesn't notice that Caps Lock is enabled, then a mode error occurs.

Causes of Slips

- **Inattention!**

  - Involves execution of already learned behavior

  - Insufficient attention or distraction of attention at a key moment

- **"Strong but Wrong"**

  - Sometimes due to strong **similarity** to correct behavior (capture or description slips) or high **frequency** relative to correct behavior (capture slips)

- **Speed/Accuracy tradeoff**

What kind of Error?

Slip

Lapse

Mistake

Description Slip

What kind of Error?

meant to type

```
% rm *.class
```

[select all files]

actually typed

```
% rm *>class
```

[pipe output into file class]
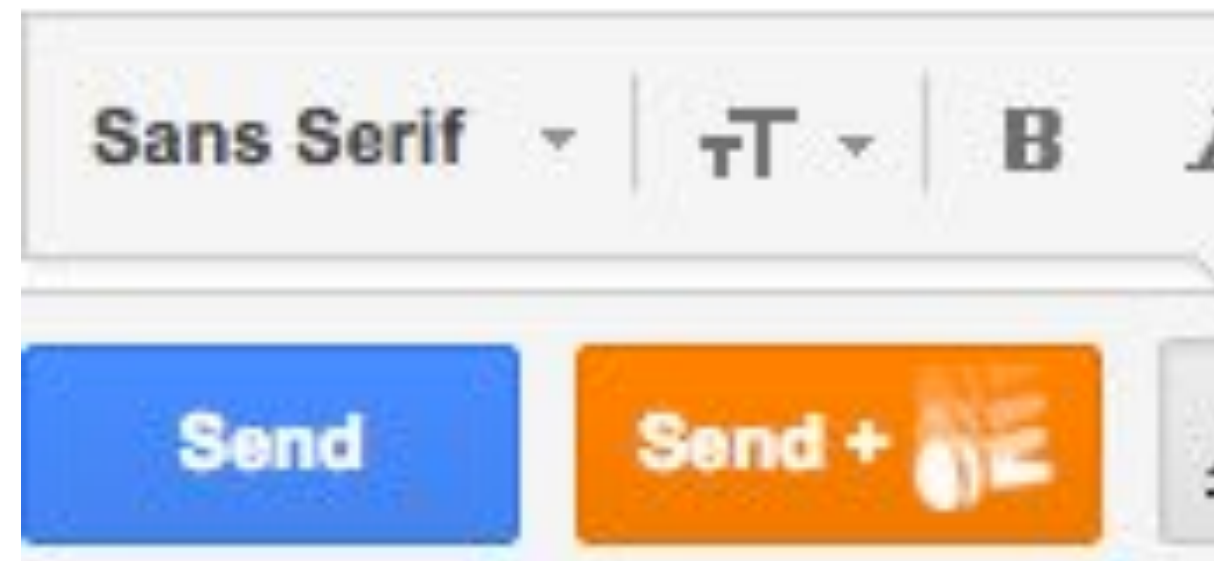
Slip

Lapse

Mistake

Mode Error
Why? Look at where . and > are on your keyboard!

Preventing Errors

Remember Consistency

- Similar things should look and act similarly -> **Different things should look different**

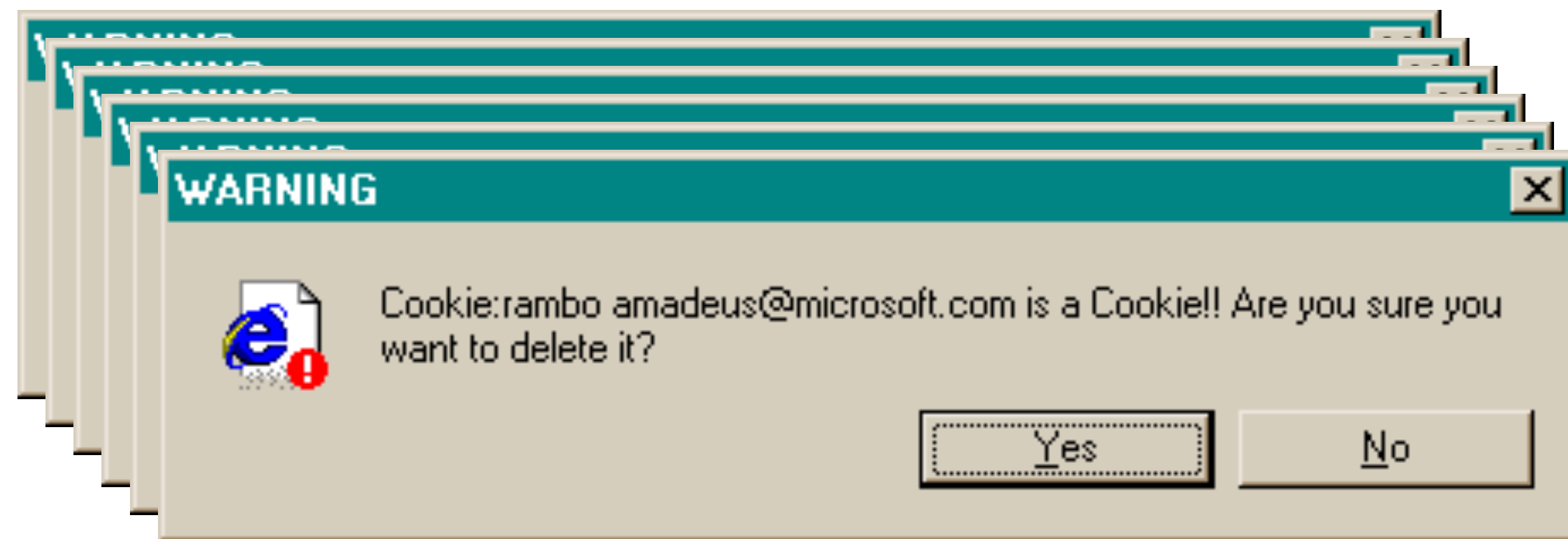- Keep dangerous commands away from common ones!

Modes: yes or no?

- Generally speaking, eliminate modes

- If you must use them:

  - Increase visibility of modes
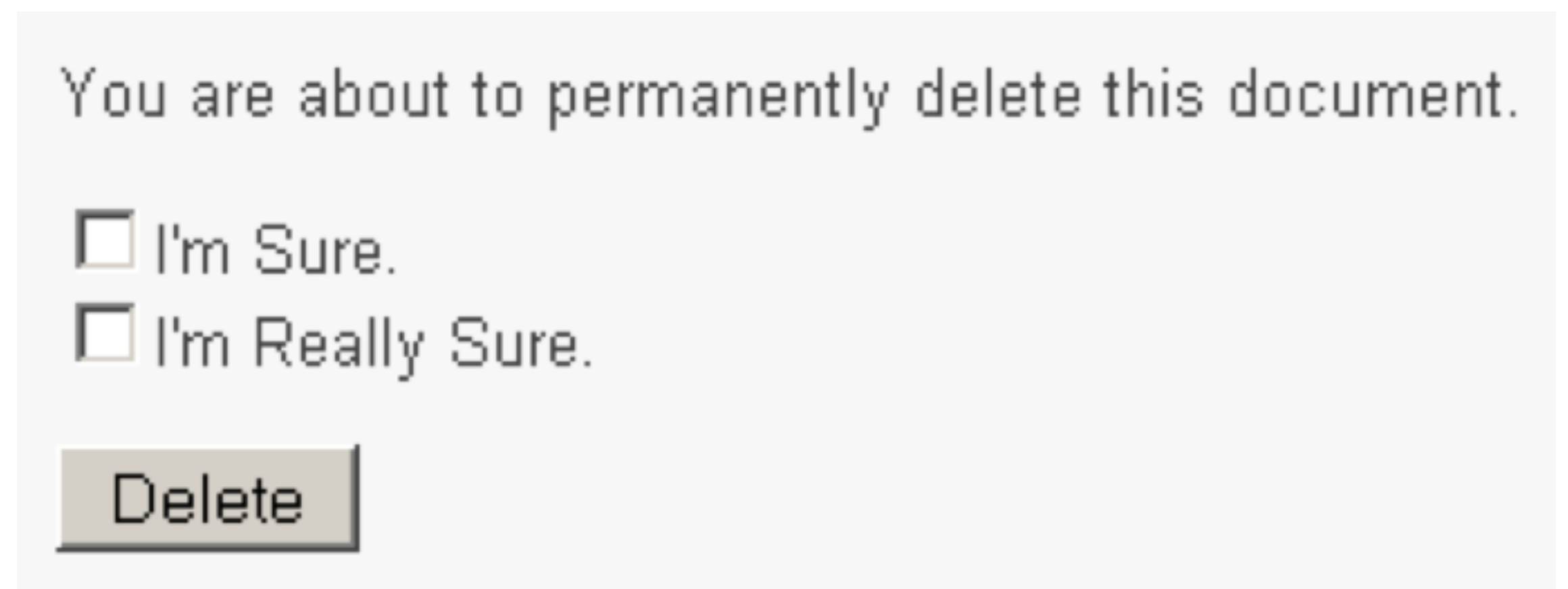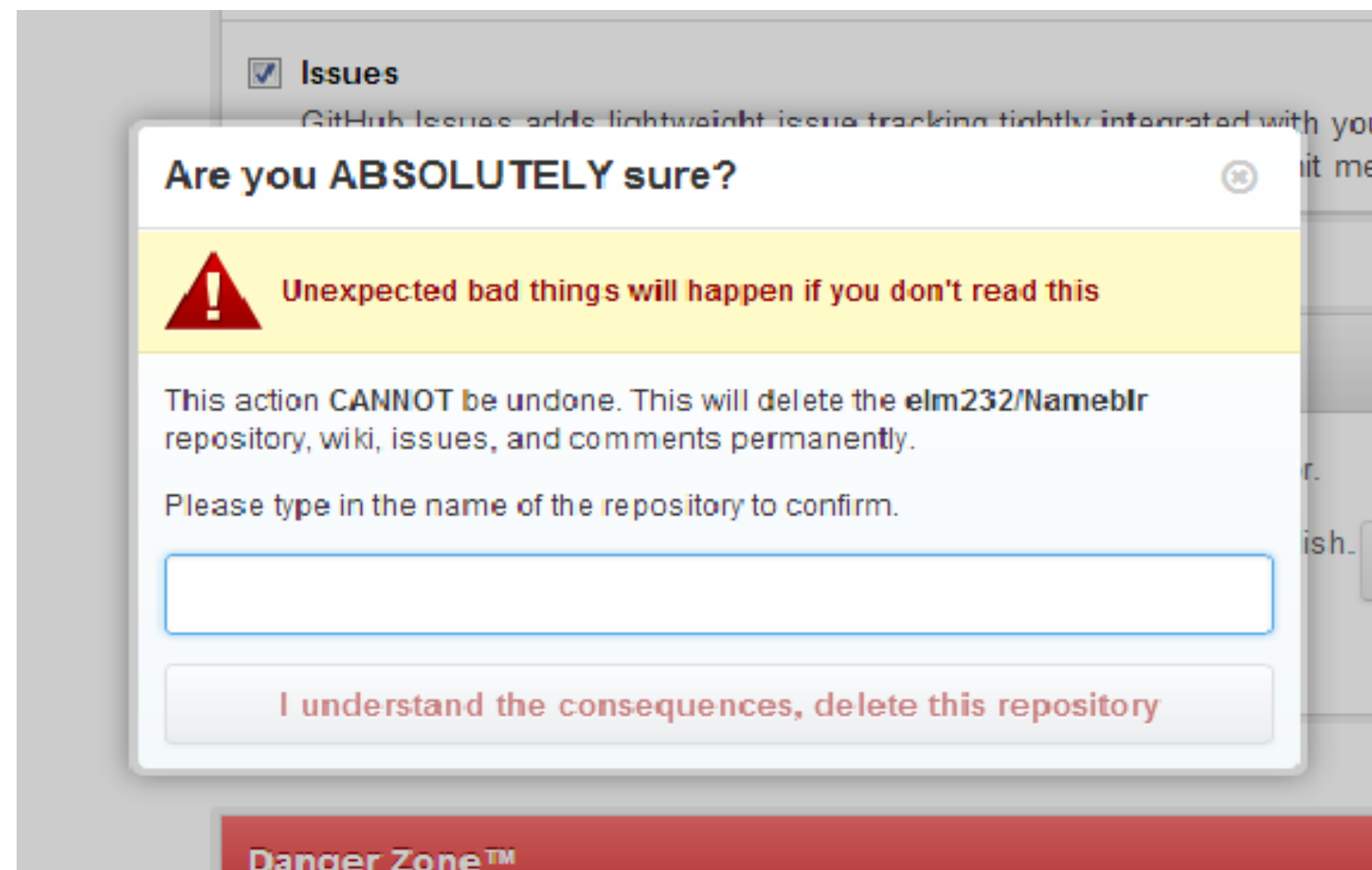
  - Spring-loaded or temporary modes
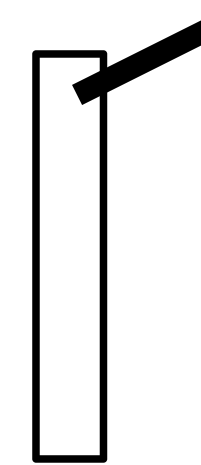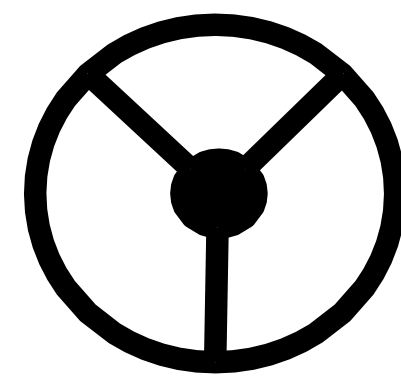
Should you use confirmation dialogs?

- Reduces inefficiency, requiring 2 actions now when it was 1.

- If frequently seen, then expert users will learn to expect it and habitually press OK without reading or noticing it! Now we're back to square one.

- In general, reversibility (i.e., **undo**) is a better solution.

Should you use confirmation dialogs?

- You should use it for **rare, catastrophic** events.

- Make it look very different from everything else

- Draw attention to it: no OK button, forces you to think

Issues
GitHub Issues adds lightweight issue tracking tightly integrated with you...

Are you ABSOLUTELY sure?

⚠ Unexpected bad things will happen if you don't read this

This action CANNOT be undone. This will delete the elm232/Nameblr repository, wiki, issues, and comments permanently.

Please type in the name of the repository to confirm.

I understand the consequences, delete this repository

Danger Zone™

You are about to permanently delete this document.

☐ I'm Sure.
☐ I'm Really Sure.

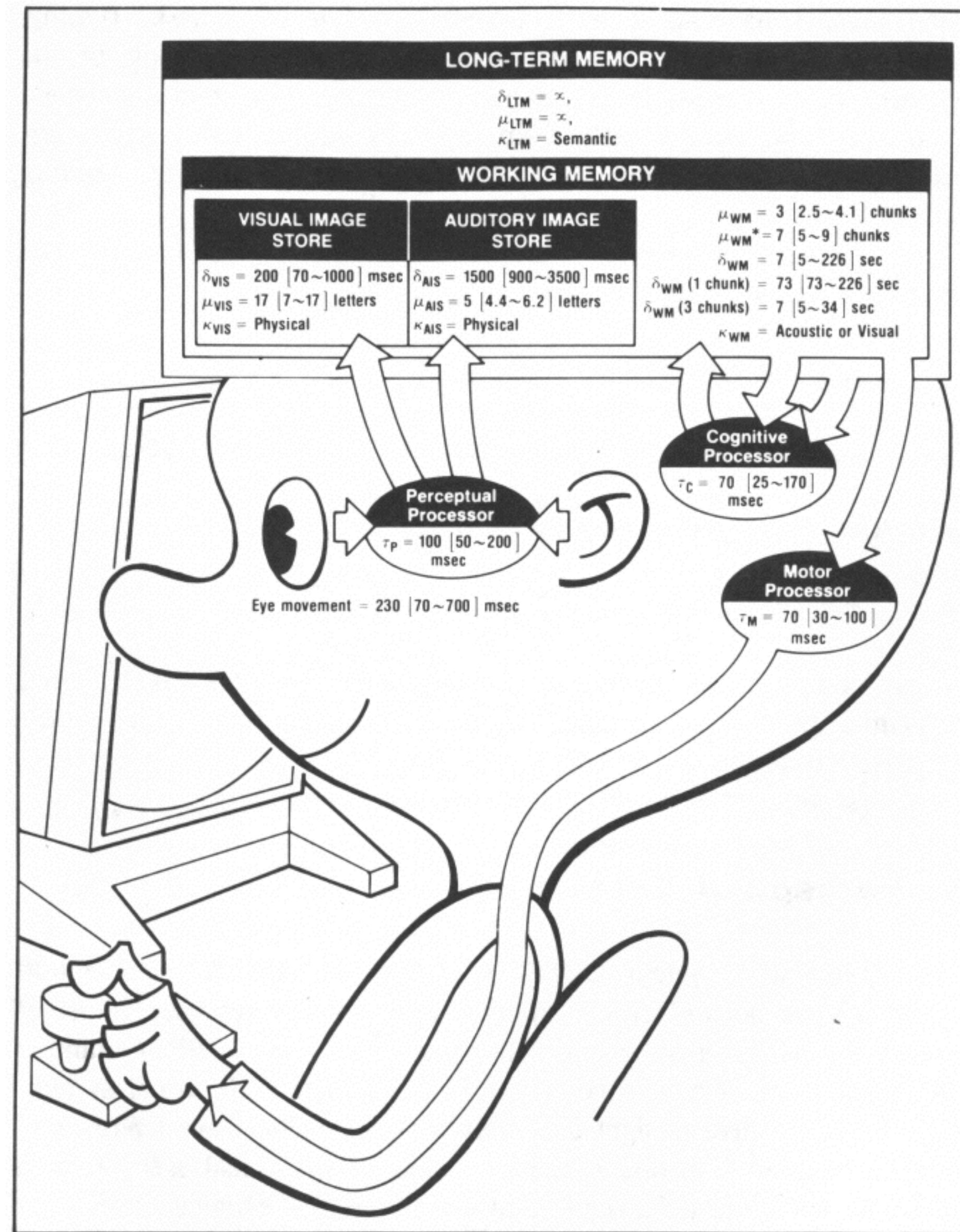Delete

Autopilot

Manual

Disconnected

Activity

- Think about a time when you encountered problems due to a system's lack of safety

- What did you do?
- What was the outcome?
- How might you change the system to prevent the problem?

Submit your answers on the following form: http://www.yellkey.com/eat

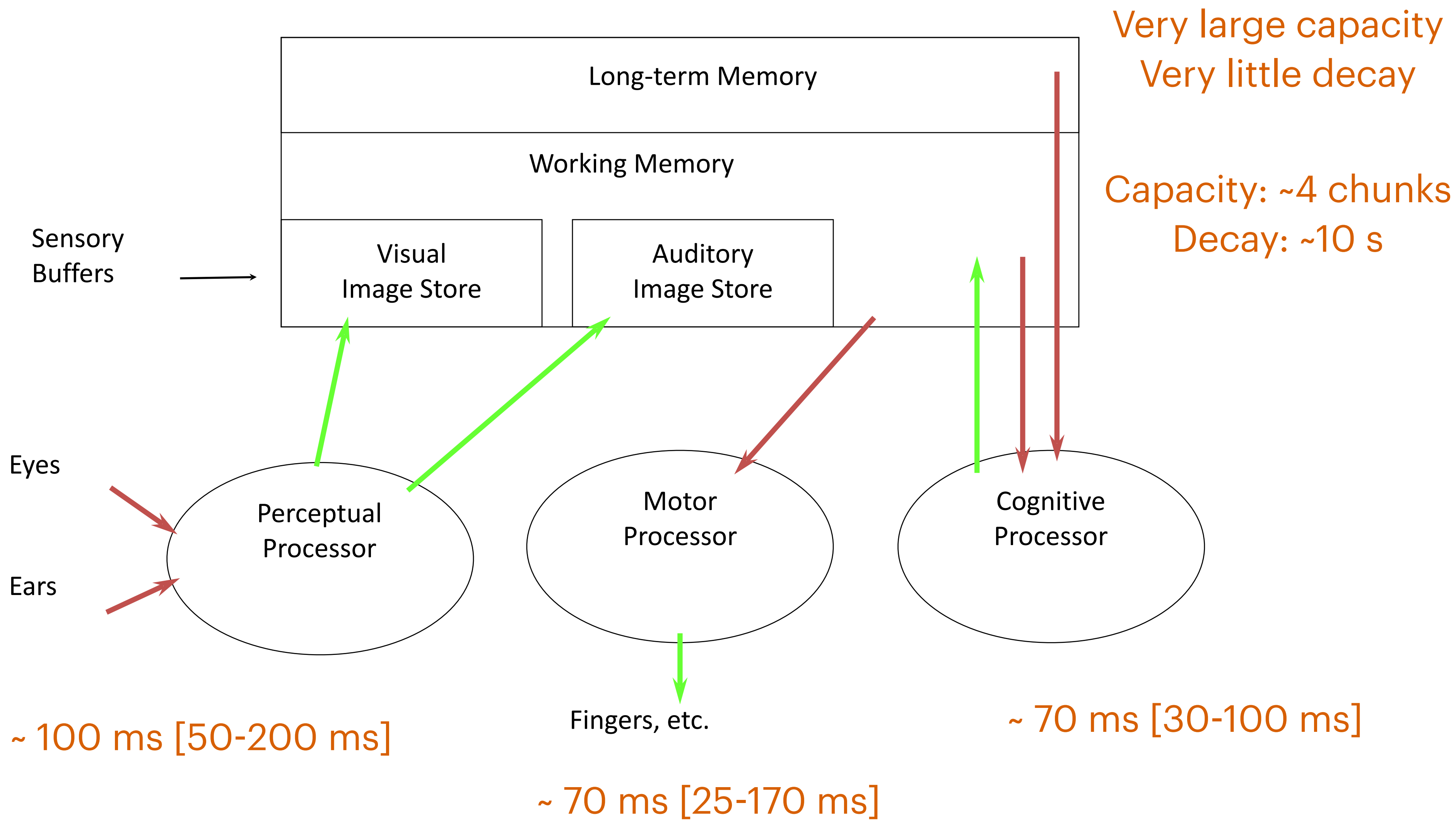Efficiency

Model Human Processor

The Model Human Processor

Developed by Card, Moran, & Newell (1983)

Based on empirical data
Summarizing human behavior in a manner easy to consume and act upon

Same book that named human computer interaction

Long-term Memory

Working Memory

Visual Image Store

Auditory Image Store

Very large capacity
Very little decay

Capacity: ~4 chunks
Decay: ~10 s

Sensory Buffers

Eyes

Ears

Perceptual Processor

Motor Processor

Cognitive Processor

Fingers, etc.

~ 100 ms [50-200 ms]

~ 70 ms [25-170 ms]

~ 70 ms [30-100 ms]

Chunking

- A "chunk" is a unit of memory or perception
  - In one sense, chunks are defined symbols; in another sense, a chunk represents the activation of past experience.
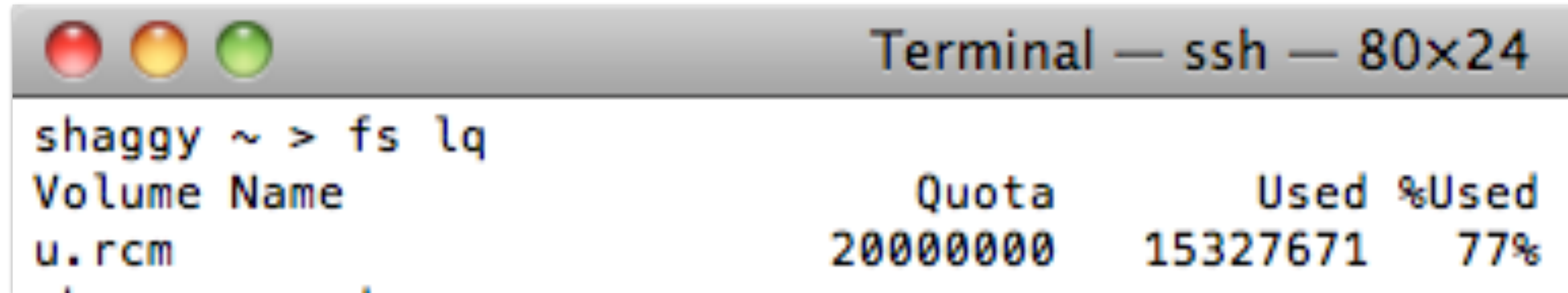
Memory

- Working memory: Small! ~4 chunks. Short-lived: ~10 seconds

- Our ability to form chunks in working memory depend on how the information is presented!

  - Grouping will improve efficiency of output to add to working memory

  - As will making the groups more familiar

Hard: M W B C R A L O A B I M B F I
Easier: MWB / CRA / LOA / BIM / BFI
Easiest: BMW / RCA / AOL / IBM / FBI

Activity


```
shaggy ~ > fs lq
Volume Name                              Quota        Used %Used
u.rcm                                20000000    15327671   77%
```

- Let's redesign this filesystem quota display for the
  command line so that it's more efficient.
  Remember to consider user goals.

- Sketch it on paper (but remember this is for the
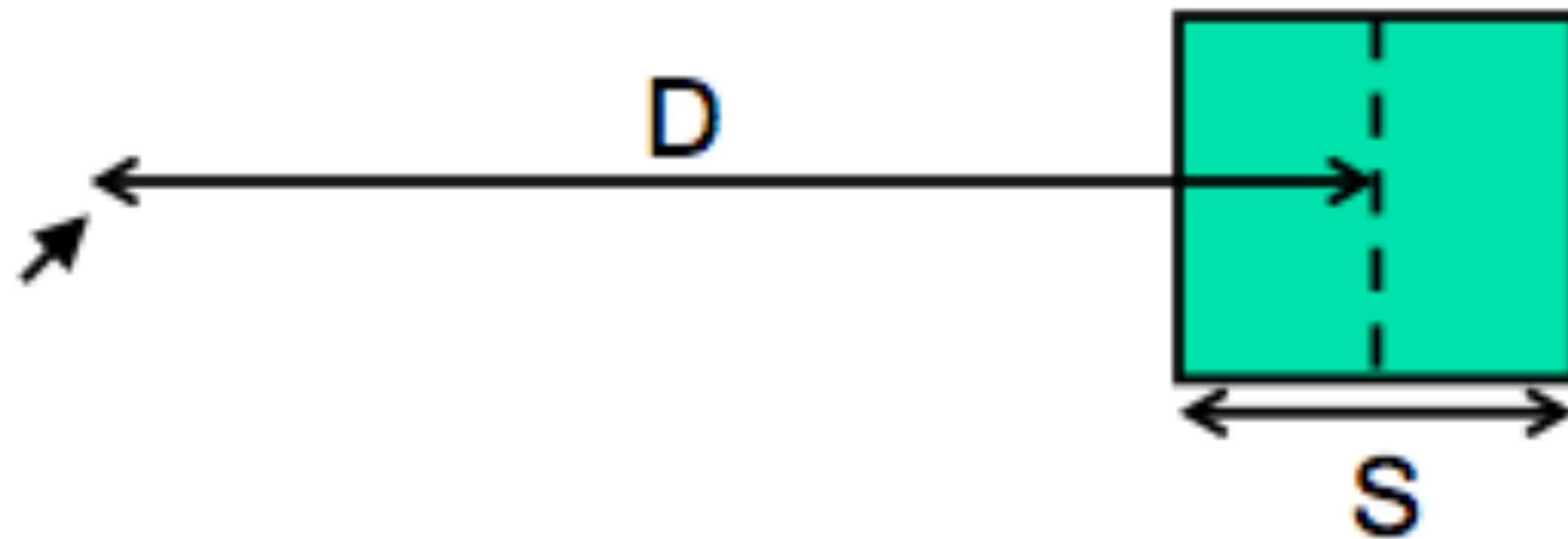 command line)!

- Submit: http://www.yellkey.com/million

Fitt's Law

Fitt's Law (1954)

- Models time to acquire targets in aimed movement

  - Reaching for a control in a cockpit

  - Moving across a dashboard

  - Pulling defective items from a conveyor belt

  - Clicking on icons using a mouse

- Very powerful, widely used

  - Holds for many circumstances (e.g., under water)

  - Allows for comparison among different experiments

  - Used both to measure and to predict

Time T to move your hand to a target of size S at distance D away is:

$$T = \text{Reaction Time} + \text{Movement Time} = a + b \log (D/S + 1)$$

As D goes up, time goes up.
As S goes up, time goes down.

important part of the equation is the
Index of Difficulty (ID): log (D/S + 1)

Fitts's Law claims that the time to acquire a target increases linearly with the log of the ratio of the movement distance (D) to target size (S)
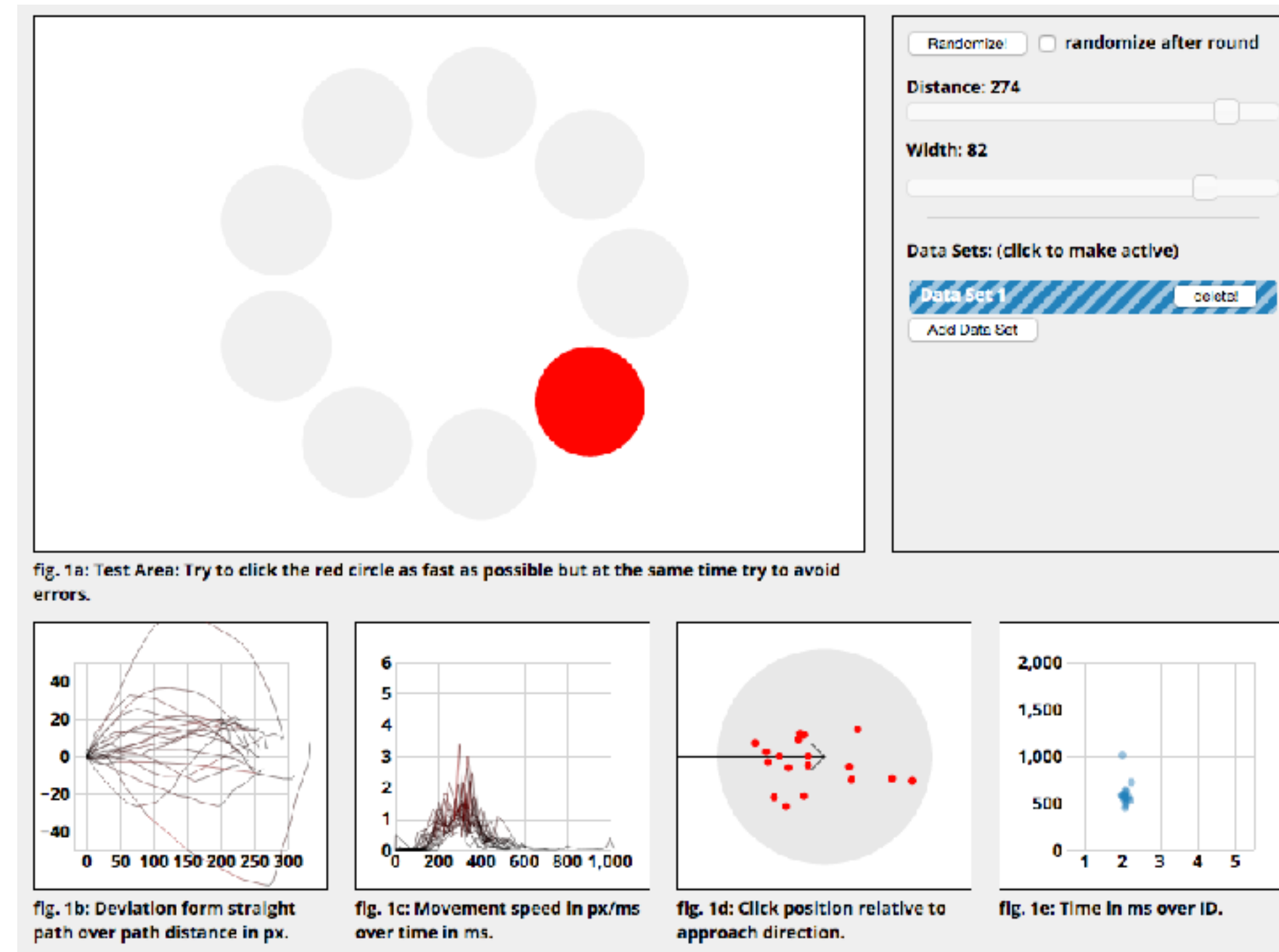
As D goes up, difficulty goes up.
As S goes up, difficulty goes down.

Because it's a ratio, units of D and S don't matter!
Allows comparison across experiments

Fitts's Law

interactive Fitts' law test

http://www.simonwallner.at/ext/fitts/

fig. 1a: Test Area: Try to click the red circle as fast as possible but at the same time try to avoid errors.

fig. 1b: Deviation form straight path over path distance in px.

fig. 1c: Movement speed in px/ms over time in ms.

fig. 1d: Click position relative to approach direction.

fig. 1e: Time in ms over ID.

- **Trial 1:** Easy: make targets large, put them close
- **Trial 2:** Harder: make targets small, space them out

- Click around the circle a couple times
- Look at the figures to compare & understand

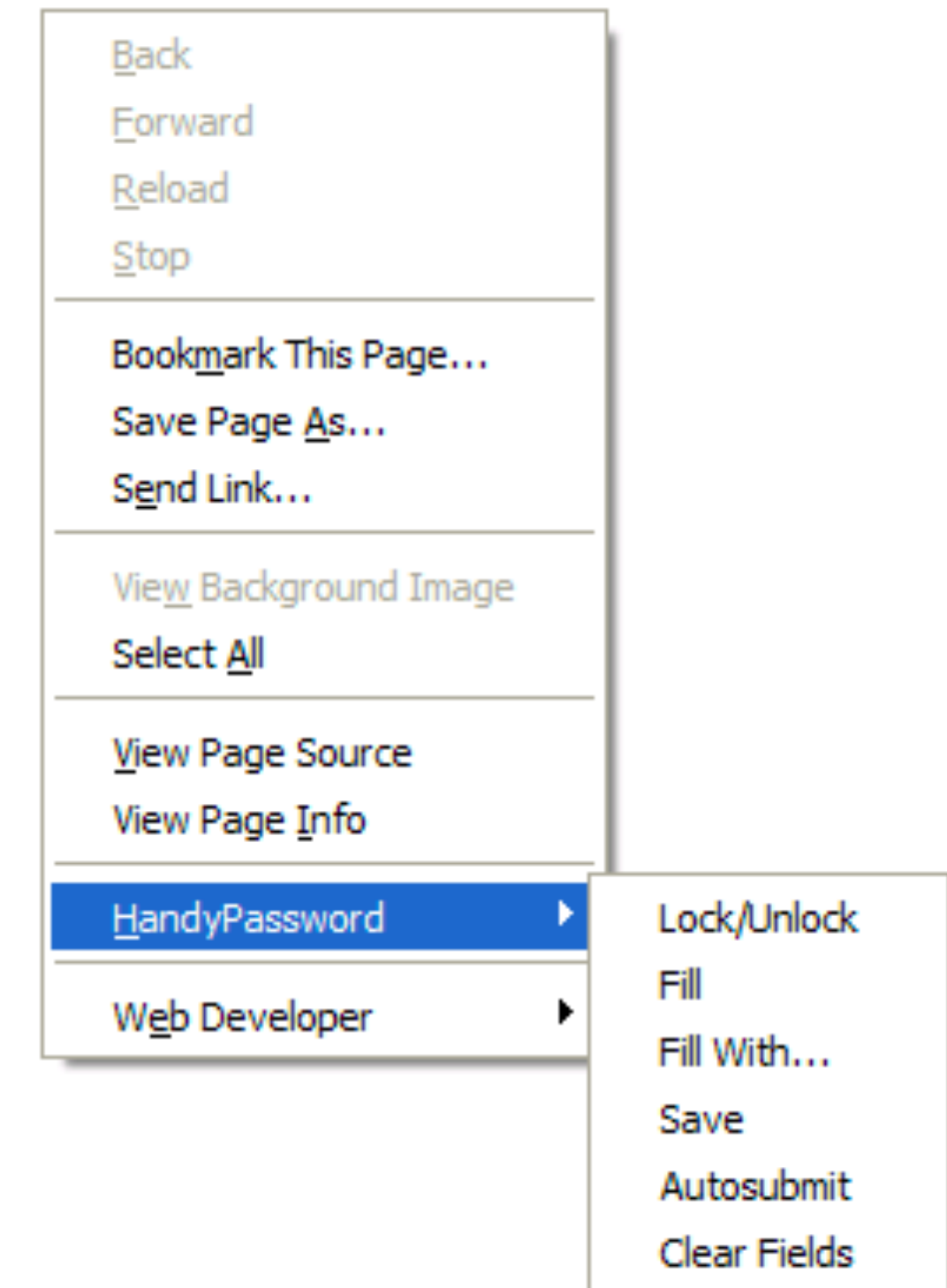T = Reaction Time + Movement Time = $a + b \log (D/S + 1)$

a = reaction time

what is b? b = **throughput**

- bandwidth of the communication channel from the human to the computer
- can be affected by anything from human (motor skills, fatigue), input device, display/feedback/perceptual skills
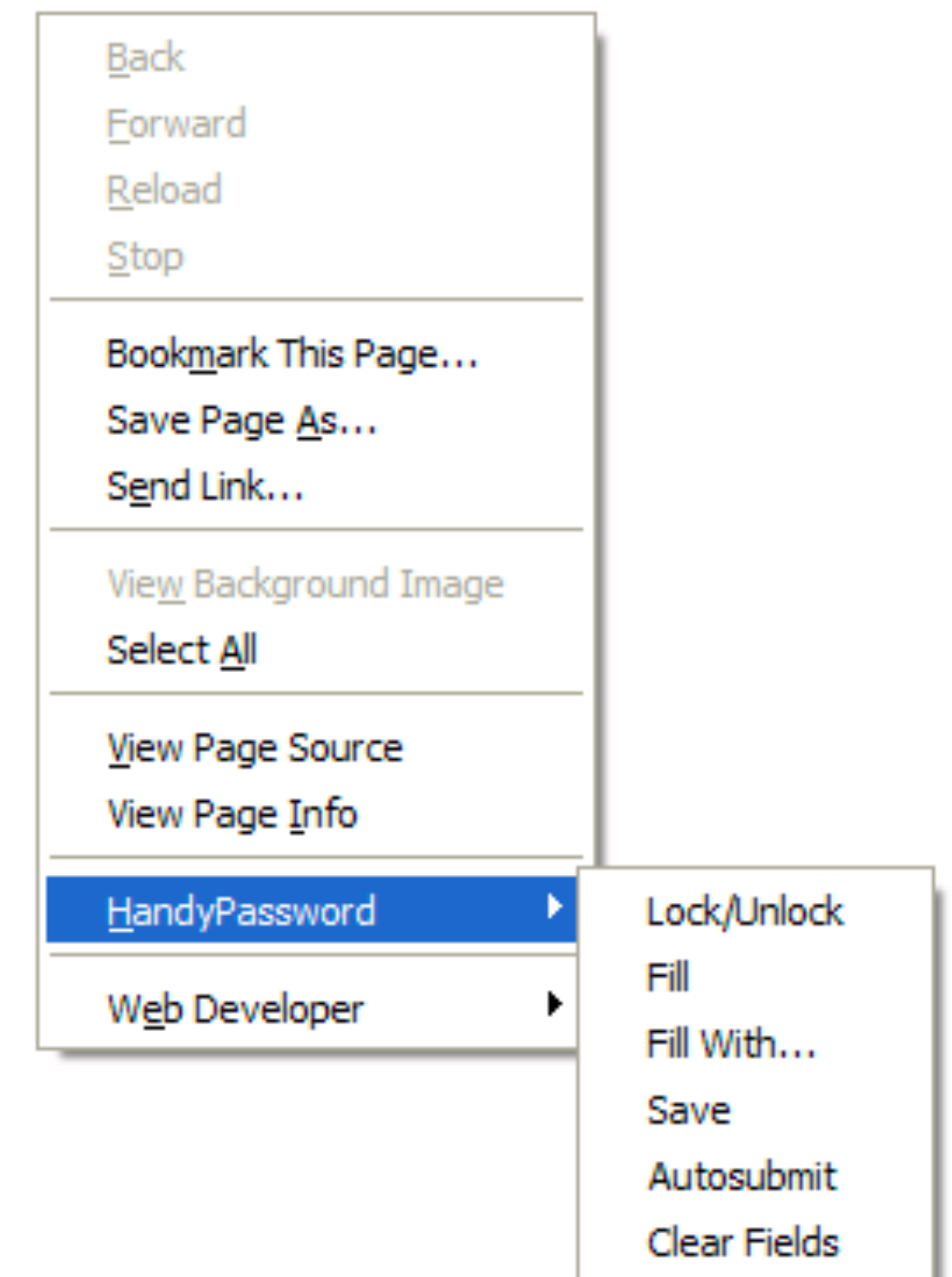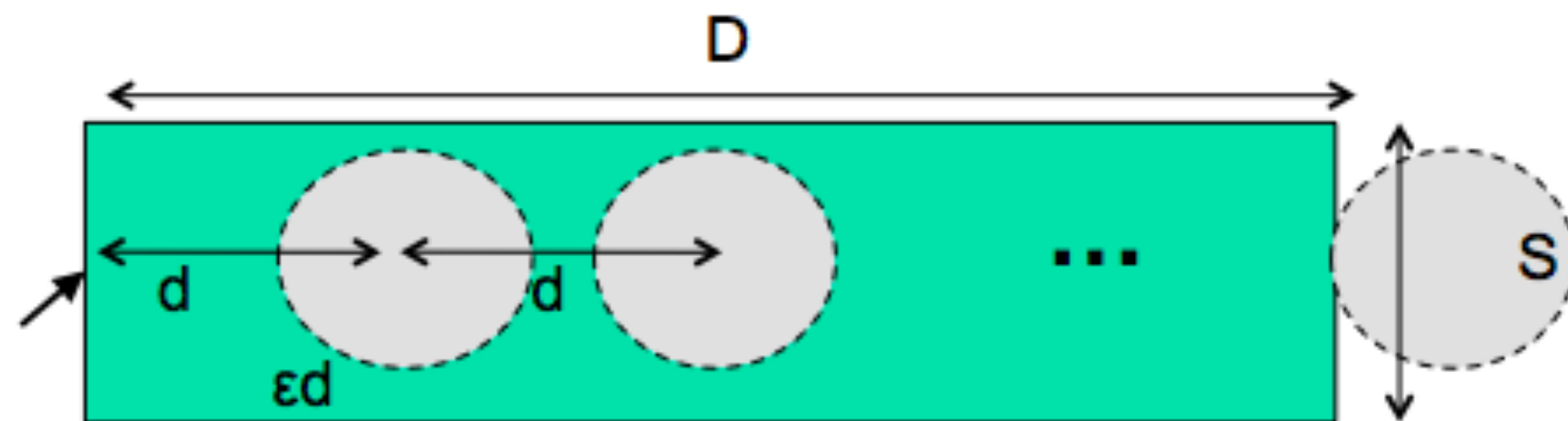
Implications of Fitt's Law

- Targets at the screen edge are easy to hit

  - Save them for frequent actions!

  - Unclickable margins are a bad idea

- Pie menus are actually easier than linear popup menus! (doesn't mean you should use them)

Steering Tasks

- **Steering** is much harder than pointing because it constrains the size of the error you can make as you're moving towards a target.

- Thus, cascading submenus are hard to use

Takeaways

- Make frequently-used targets big

- Put targets used together near each other

- Use screen corners and screen edges

- Avoid steering tasks

Team presentations for 2a

- Pairs of groups

- Try to keep track of time so that teams get an equal amount of time

- Start out by talking through the final group project problem space that you landed on through ideation and feedback.

- Then pick out 3-6 of your sketches for feedback. Remember at this point, you're still aiming for idea generation, so try to pick very different ones!

- Remember, for critics: "I like, I wish, What if"